SEQUENCE LISTING

<110> Asakura, Akira
Hoshino, Tatsuo
Shinjoh, Masako

<120> Cytochrome C Oxidase Enzyme Complex

<130> C38435/111693

<140> 09/712.768
<141> 2000-11-14

<150> EP 99122842
<151> 1999-11-17

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<170> PatentIn version 3.1

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<213> Gluconobacter oxydans

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ttc ttc acg cgc tgg ttc atg tcg acc aac cac aaa gac atc ggt ctg       96
Phe Phe Thr Arg Trp Phe Met Ser Thr Asn His Lys Asp Ile Gly Leu
            20                  25                  30

cta tac ctt gta gcg gct ggt gtt gtt ggt ttc att tcc gtc ctg ttc      144
Leu Tyr Leu Val Ala Ala Gly Val Val Gly Phe Ile Ser Val Leu Phe
        35                  40                  45

acc gtc tac atg cgc ctt gag ctg atg gat ccg ggt gtt cag tac atg      192
Thr Val Tyr Met Arg Leu Glu Leu Met Asp Pro Gly Val Gln Tyr Met
    50                  55                  60

tgc ctt gaa ggc gca cgt ctg atc gcg gat gcc tcg cag aca tgt acg      240
Cys Leu Glu Gly Ala Arg Leu Ile Ala Asp Ala Ser Gln Thr Cys Thr
65                  70                  75                  80

gcg aac gga cac ctg tgg aac gtc atg gtt acc tac cat ggt att ctg      288
Ala Asn Gly His Leu Trp Asn Val Met Val Thr Tyr His Gly Ile Leu
                85                  90                  95

atg atg ttc ttt gtg ggt atc ccc gca ttg ttc ggt ggt ttt ggt aac      336
Met Met Phe Phe Val Gly Ile Pro Ala Leu Phe Gly Gly Phe Gly Asn
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                100                 105                 110

tat ctg atg ccg ctg caa atc ggc gct ccg gat atg gcc ttc ccg cgt      384
Tyr Leu Met Pro Leu Gln Ile Gly Ala Pro Asp Met Ala Phe Pro Arg
        115                 120                 125

atg aac aac ctg tcg ttc tgg ctg ttc att gcc ggt acc gcg atg ggc      432
Met Asn Asn Leu Ser Phe Trp Leu Phe Ile Ala Gly Thr Ala Met Gly
    130                 135                 140

gtg gct tcg ctg ttc gca ccg ggc ggt gac ggt cag ctg ggt tcg ggc      480
Val Ala Ser Leu Phe Ala Pro Gly Gly Asp Gly Gln Leu Gly Ser Gly
145                 150                 155                 160

gtt ggt tgg gtt ctg tac ccg ccg ctg tcg acc cgc gaa gct ggc tat      528
Val Gly Trp Val Leu Tyr Pro Pro Leu Ser Thr Arg Glu Ala Gly Tyr
                165                 170                 175

tcg atg gac ctc gcg att ttc gcg gtt cac ttg tcg ggt gcc tcc tcg      576
Ser Met Asp Leu Ala Ile Phe Ala Val His Leu Ser Gly Ala Ser Ser
            180                 185                 190

atc atg ggc gcg atc aac atg atc acg acc ttc ttg aac atg cgc gcc      624
Ile Met Gly Ala Ile Asn Met Ile Thr Thr Phe Leu Asn Met Arg Ala
        195                 200                 205

ccc ggc atg acg ctg cac aaa gtg ccg ttg ttc tcg tgg tcg atc ttt      672
Pro Gly Met Thr Leu His Lys Val Pro Leu Phe Ser Trp Ser Ile Phe
    210                 215                 220

atc acg gct tgg ctg atc ctg ctg gcg ctg ccg gtt ctg gct ggt gca      720
Ile Thr Ala Trp Leu Ile Leu Leu Ala Leu Pro Val Leu Ala Gly Ala
225                 230                 235                 240

atc acc atg ctg ctg acc gac cgt aac ttc ggc acg acc ttc ttc aat      768
Ile Thr Met Leu Leu Thr Asp Arg Asn Phe Gly Thr Thr Phe Phe Asn
                245                 250                 255

cct gct ggc ggc ggt gac ccg att ctg tac caa cac atc ctg tgg ttc      816
Pro Ala Gly Gly Gly Asp Pro Ile Leu Tyr Gln His Ile Leu Trp Phe
            260                 265                 270

ttt ggg cac ccg gaa gtg tac atc atc att ctg ccc ggc ttt ggc atc      864
Phe Gly His Pro Glu Val Tyr Ile Ile Ile Leu Pro Gly Phe Gly Ile
        275                 280                 285

atc agc cat gtc gtg tcg acc ttc tcg aaa aag ccg gtc ttc ggt tac      912
Ile Ser His Val Val Ser Thr Phe Ser Lys Lys Pro Val Phe Gly Tyr
    290                 295                 300

ctg ccg atg gtc tat gca atg gtg gca atc ggt gtt ctg ggc ttt gtc      960
Leu Pro Met Val Tyr Ala Met Val Ala Ile Gly Val Leu Gly Phe Val
305                 310                 315                 320

gtc tgg gcg cac cac atg tac acc gtt ggt atg tcg ctg acc cag caa     1008
Val Trp Ala His His Met Tyr Thr Val Gly Met Ser Leu Thr Gln Gln
                325                 330                 335
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tcc tac ttc atg ctg gcc acc atg gtg atc gcg gtg ccg acc ggc att      1056
Ser Tyr Phe Met Leu Ala Thr Met Val Ile Ala Val Pro Thr Gly Ile
            340                 345                 350

aag atc ttc tcg tgg atc gcc acg atg tgg ggc ggc tcg gtt gag ttc      1104
Lys Ile Phe Ser Trp Ile Ala Thr Met Trp Gly Gly Ser Val Glu Phe
        355                 360                 365

aaa tcg ccg atg ctc tgg gcc ttt ggc ttt atg ttc ctg ttc acc gtg      1152
Lys Ser Pro Met Leu Trp Ala Phe Gly Phe Met Phe Leu Phe Thr Val
    370                 375                 380

ggt ggt gtg acc ggt atc gtg ctg gcc caa gcg ggt ctg gac cgt gca      1200
Gly Gly Val Thr Gly Ile Val Leu Ala Gln Ala Gly Leu Asp Arg Ala
385                 390                 395                 400

tat cac gac acc tat tac gtg gtg gcg cac ttc cat tat gtg atg tcg      1248
Tyr His Asp Thr Tyr Tyr Val Val Ala His Phe His Tyr Val Met Ser
                405                 410                 415

ctg ggt gcg atc ttt gcg atc ttc gcc ggt atc tac ttt tac atg ccg      1296
Leu Gly Ala Ile Phe Ala Ile Phe Ala Gly Ile Tyr Phe Tyr Met Pro
            420                 425                 430

aag ttc tcg ggc cgc gct ttc ccg gaa tgg gct gca aag ctg cac ttc      1344
Lys Phe Ser Gly Arg Ala Phe Pro Glu Trp Ala Ala Lys Leu His Phe
        435                 440                 445

tgg acc ttc ttc atc ggt gcg aac gtc acg ttc ttc ccg cag cac ttc      1392
Trp Thr Phe Phe Ile Gly Ala Asn Val Thr Phe Phe Pro Gln His Phe
    450                 455                 460

ctg gga cgt cag ggt atg ccg cgc cgt tac atc gac tat ccc gaa gcc      1440
Leu Gly Arg Gln Gly Met Pro Arg Arg Tyr Ile Asp Tyr Pro Glu Ala
465                 470                 475                 480

ttc gcg ctg tgg aac aaa gtc tcg tcc tat ggt gcg ttc ctg gcc ttc      1488
Phe Ala Leu Trp Asn Lys Val Ser Ser Tyr Gly Ala Phe Leu Ala Phe
                485                 490                 495

gcc tcg ttc ctg ttc ttc atc gtg atc ttt gtc tat acg ctg gtt gct      1536
Ala Ser Phe Leu Phe Phe Ile Val Ile Phe Val Tyr Thr Leu Val Ala
            500                 505                 510

ggc cgc cgc gag acc cgt ccg aac ccg tgg ggc gaa ttc gcc gat acg      1584
Gly Arg Arg Glu Thr Arg Pro Asn Pro Trp Gly Glu Phe Ala Asp Thr
        515                 520                 525

ctg gaa tgg acg ctg cca tca ccg cct ccg gcc cac acg ttc gaa acg      1632
Leu Glu Trp Thr Leu Pro Ser Pro Pro Pro Ala His Thr Phe Glu Thr
    530                 535                 540

ctg ccc aag cgc tcg gac tgg gac aag cat ccc tcg cac taa              1674
Leu Pro Lys Arg Ser Asp Trp Asp Lys His Pro Ser His
545                 550                 555
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Q1

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<213> Gluconobacter oxydans

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Phe Phe Thr Arg Trp Phe Met Ser Thr Asn His Lys Asp Ile Gly Leu
20 25 30

Leu Tyr Leu Val Ala Ala Gly Val Val Gly Phe Ile Ser Val Leu Phe
35 40 45

Thr Val Tyr Met Arg Leu Glu Leu Met Asp Pro Gly Val Gln Tyr Met
50 55 60

Cys Leu Glu Gly Ala Arg Leu Ile Ala Asp Ala Ser Gln Thr Cys Thr
65 70 75 80

Ala Asn Gly His Leu Trp Asn Val Met Val Thr Tyr His Gly Ile Leu
85 90 95

Met Met Phe Phe Val Gly Ile Pro Ala Leu Phe Gly Gly Phe Gly Asn
100 105 110

Tyr Leu Met Pro Leu Gln Ile Gly Ala Pro Asp Met Ala Phe Pro Arg
115 120 125

Met Asn Asn Leu Ser Phe Trp Leu Phe Ile Ala Gly Thr Ala Met Gly
130 135 140

Val Ala Ser Leu Phe Ala Pro Gly Gly Asp Gly Gln Leu Gly Ser Gly
145 150 155 160

Val Gly Trp Val Leu Tyr Pro Pro Leu Ser Thr Arg Glu Ala Gly Tyr
165 170 175

Ser Met Asp Leu Ala Ile Phe Ala Val His Leu Ser Gly Ala Ser Ser
180 185 190

Ile Met Gly Ala Ile Asn Met Ile Thr Thr Phe Leu Asn Met Arg Ala

195 200 205

Pro Gly Met Thr Leu His Lys Val Pro Leu Phe Ser Trp Ser Ile Phe
210 215 220

Ile Thr Ala Trp Leu Ile Leu Leu Ala Leu Pro Val Leu Ala Gly Ala
225 230 235 240

Ile Thr Met Leu Leu Thr Asp Arg Asn Phe Gly Thr Thr Phe Phe Asn
245 250 255

Pro Ala Gly Gly Gly Asp Pro Ile Leu Tyr Gln His Ile Leu Trp Phe
260 265 270

Phe Gly His Pro Glu Val Tyr Ile Ile Ile Leu Pro Gly Phe Gly Ile
275 280 285

Q1

Ile Ser His Val Val Ser Thr Phe Ser Lys Lys Pro Val Phe Gly Tyr
290 295 300

Leu Pro Met Val Tyr Ala Met Val Ala Ile Gly Val Leu Gly Phe Val
305 310 315 320

Val Trp Ala His His Met Tyr Thr Val Gly Met Ser Leu Thr Gln Gln
325 330 335

Ser Tyr Phe Met Leu Ala Thr Met Val Ile Ala Val Pro Thr Gly Ile
340 345 350

Lys Ile Phe Ser Trp Ile Ala Thr Met Trp Gly Gly Ser Val Glu Phe
355 360 365

Lys Ser Pro Met Leu Trp Ala Phe Gly Phe Met Phe Leu Phe Thr Val
370 375 380

Gly Gly Val Thr Gly Ile Val Leu Ala Gln Ala Gly Leu Asp Arg Ala
385 390 395 400

Tyr His Asp Thr Tyr Tyr Val Val Ala His Phe His Tyr Val Met Ser
405 410 415

Leu Gly Ala Ile Phe Ala Ile Phe Ala Gly Ile Tyr Phe Tyr Met Pro
420 425 430

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Lys Phe Ser Gly Arg Ala Phe Pro Glu Trp Ala Ala Lys Leu His Phe
        435                 440                 445

Trp Thr Phe Phe Ile Gly Ala Asn Val Thr Phe Phe Pro Gln His Phe
    450                 455                 460

Leu Gly Arg Gln Gly Met Pro Arg Arg Tyr Ile Asp Tyr Pro Glu Ala
465                 470                 475                 480

Phe Ala Leu Trp Asn Lys Val Ser Ser Tyr Gly Ala Phe Leu Ala Phe
                485                 490                 495

Ala Ser Phe Leu Phe Phe Ile Val Ile Phe Val Tyr Thr Leu Val Ala
            500                 505                 510

Gly Arg Arg Glu Thr Arg Pro Asn Pro Trp Gly Glu Phe Ala Asp Thr
        515                 520                 525

Leu Glu Trp Thr Leu Pro Ser Pro Pro Pro Ala His Thr Phe Glu Thr
    530                 535                 540

Leu Pro Lys Arg Ser Asp Trp Asp Lys His Pro Ser His
545                 550                 555
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Pro Leu Glu Ile Val Trp Thr Ile Val Pro Val Val Ile Leu Val Phe
1               5                  10                  15

atc ggt gcg ttc tcg ctg ccg gtg ctg ttc aaa cag caa gag ttc ccc      96
Ile Gly Ala Phe Ser Leu Pro Val Leu Phe Lys Gln Gln Glu Phe Pro
            20                  25                  30

gag ggt gac atc gtc atc aac gtc gag ggt cgt agc                     132
Glu Gly Asp Ile Val Ile Asn Val Glu Gly Arg Ser
        35                  40
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<210> 4
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<212> PRT
<213> Gluconobacter oxydans

<400> 4

Pro Leu Glu Ile Val Trp Thr Ile Val Pro Val Val Ile Leu Val Phe
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Ile Gly Ala Phe Ser Leu Pro Val Leu Phe Lys Gln Gln Glu Phe Pro
20 25 30

Glu Gly Asp Ile Val Ile Asn Val Glu Gly Arg Ser
35 40

<210> 5
<211> 114
<212> DNA
<213> Gluconobacter oxydans

<220>
<221> CDS
<222> (1)..(114)
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atc gtc cac ggc gac cgc aag aaa acc gcg att ggc cta gcg att gcc 48
Ile Val His Gly Asp Arg Lys Lys Thr Ala Ile Gly Leu Ala Ile Ala
1 5 10 15

atc ggc ctt ggc tgg atc ttt acc ctg tgc caa gcc tat gaa tat tat 96
Ile Gly Leu Gly Trp Ile Phe Thr Leu Cys Gln Ala Tyr Glu Tyr Tyr
20 25 30

gaa atc gtc cat acc gaa 114
Glu Ile Val His Thr Glu
35

<210> 6
<211> 38
<212> PRT
<213> Gluconobacter oxydans

<400> 6

Ile Val His Gly Asp Arg Lys Lys Thr Ala Ile Gly Leu Ala Ile Ala
1 5 10 15

Ile Gly Leu Gly Trp Ile Phe Thr Leu Cys Gln Ala Tyr Glu Tyr Tyr
20 25 30

Glu Ile Val His Thr Glu
35

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<212> DNA
<213> Gluconobacter oxydans

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<221> CDS
<222> (1)..(87)
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gat tcg atc ttc ctg ctg gtc tgc ctg atc cgc atc ctg cgc ggt gcg 48
Asp Ser Ile Phe Leu Leu Val Cys Leu Ile Arg Ile Leu Arg Gly Ala
1 5 10 15

atg tcg gca aaa cag cac gtc ggt ttc gag atg gcc gca 87
Met Ser Ala Lys Gln His Val Gly Phe Glu Met Ala Ala
20 25

Q1

<210> 8
<211> 29
<212> PRT
<213> Gluconobacter oxydans

<400> 8

Asp Ser Ile Phe Leu Leu Val Cys Leu Ile Arg Ile Leu Arg Gly Ala
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Met Ser Ala Lys Gln His Val Gly Phe Glu Met Ala Ala
20 25

<210> 9
<211> 6
<212> PRT
<213> Rhodobacter sphaeroides

<400> 9

Trp Phe Phe Gly His Pro
1 5

<210> 10
<211> 6
<212> PRT
<213> Rhodobacter sphaeroides

<400> 10

Val Trp Ala His His Met
1 5

<210> 11
<211> 16
<212> PRT
<213> Gluconobacter oxydans

<220>
<221> PEPTIDE
<222> (1)..(16)
<223>

<400> 11

Lys Asp Ile Gly Leu Leu Tyr Leu Val Ala Ala Gly Val Val Gly Phe
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<210> 12
<211> 168
<212> DNA
<213> Gluconobacter oxydans

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<222> (1)..(168)
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Trp Phe Phe Gly His Pro Glu Val Tyr Ile Ile Ile Leu Pro Gly Phe
1               5                  10                  15

ggc atc atc agc cat gtc gtg tcg acc ttc tcg aaa aag ccg gtc ttc       96
Gly Ile Ile Ser His Val Val Ser Thr Phe Ser Lys Lys Pro Val Phe
            20                  25                  30

ggt tac ctg ccg atg gtc tat gca atg ttg gca atc ggt gtt ctg ggc      144
Gly Tyr Leu Pro Met Val Tyr Ala Met Leu Ala Ile Gly Val Leu Gly
        35                  40                  45

ttt gtc gtg tgg gcg cac cat atg                                     168
Phe Val Val Trp Ala His His Met
    50                  55
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<210> 13
<211> 56
<212> PRT
<213> Gluconobacter oxydans

<400> 13

Trp Phe Phe Gly His Pro Glu Val Tyr Ile Ile Ile Leu Pro Gly Phe
1 5 10 15

Gly Ile Ile Ser His Val Val Ser Thr Phe Ser Lys Lys Pro Val Phe
20 25 30

Gly Tyr Leu Pro Met Val Tyr Ala Met Leu Ala Ile Gly Val Leu Gly
35 40 45

Phe Val Val Trp Ala His His Met
50 55

<210> 14
<211> 20
<212> PRT
<213> Gluconobacter oxydans

<220>
<221> PEPTIDE
<222> (1)..(20)
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<400> 14

Lys Ala Ser Gln Phe Thr His Asn Thr Pro Leu Glu Ile Val Trp Thr
1 5 10 15

Ile Val Pro Val
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<210> 15
<211> 6
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<213> Gluconobacter oxydans

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Gln Phe Thr His Asn Thr
1 5

<210> 16
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<213> Rhodobacter sphaeroides

<400> 16

Trp Tyr Trp Gly Tyr Glu Tyr
1 5

<210> 17
<211> 6
<212> PRT
<213> Rhodobacter sphaeroides

<400> 17

Thr Trp Ala His His Ala
1 5

<210> 18
<211> 7
<212> PRT
<213> Rhodobacter sphaeroides

<400> 18

Trp Tyr Trp His Phe Val Asp
1 5

<210> 19
<211> 554
<212> PRT
<213> Paracoccus denitrificans

<400> 19

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Thr Arg Trp Phe Met Ser Thr Asn His Lys Asp Ile Gly Val Leu Tyr
20 25 30

Leu Phe Thr Ala Gly Leu Ala Gly Leu Ile Ser Val Thr Leu Thr Val
35 40 45

Tyr Met Arg Met Glu Leu Gln His Pro Gly Val Gln Tyr Met Cys Leu
50 55 60

Glu Gly Met Arg Leu Val Ala Asp Ala Ala Ala Glu Cys Thr Pro Asn
65 70 75 80

Ala His Leu Trp Asn Val Val Val Thr Tyr His Gly Ile Leu Met Met
85 90 95

Phe Phe Val Val Ile Pro Ala Leu Phe Gly Gly Phe Gly Asn Tyr Phe
100 105 110

Met Pro Leu His Ile Gly Ala Pro Asp Met Ala Phe Pro Arg Leu Asn
115 120 125

Asn Leu Ser Tyr Trp Leu Tyr Val Cys Gly Val Ser Leu Ala Ile Ala
130 135 140

Ser Leu Leu Ser Pro Gly Gly Ser Asp Gln Pro Gly Ala Gly Val Gly
145 150 155 160

Trp Val Leu Tyr Pro Pro Leu Ser Thr Thr Glu Ala Gly Tyr Ala Met
165 170 175

Asp Leu Ala Ile Phe Ala Val His Val Ser Gly Ala Thr Ser Ile Leu
180 185 190

Gly Ala Ile Asn Ile Ile Thr Thr Phe Leu Asn Met Arg Ala Pro Gly
195 200 205

Met Thr Leu Phe Lys Val Pro Leu Phe Ala Trp Ala Val Phe Ile Thr
210 215 220

Ala Trp Met Ile Leu Leu Ser Leu Pro Val Leu Ala Gly Gly Ile Thr
225 230 235 240

Met Leu Leu Met Asp Arg Asn Phe Gly Thr Gln Phe Phe Asp Pro Ala
245 250 255

Gly Gly Gly Asp Pro Val Leu Tyr Gln His Ile Leu Trp Phe Phe Gly
260 265 270

His Pro Glu Val Tyr Met Leu Ile Leu Pro Gly Phe Gly Ile Ile Ser
275 280 285

His Val Ile Ser Thr Phe Ala Arg Lys Pro Ile Phe Gly Tyr Leu Pro
290 295 300

Met Val Leu Ala Met Ala Ala Ile Ala Phe Leu Gly Phe Ile Val Trp
305 310 315 320

Ala His His Met Tyr Thr Ala Gly Met Ser Leu Thr Gln Gln Thr Tyr
325 330 335

Phe Gln Met Ala Thr Met Thr Ile Ala Val Pro Thr Gly Ile Lys Val
340 345 350

Phe Ser Trp Ile Ala Thr Met Trp Gly Gly Ser Ile Glu Phe Lys Thr
355 360 365

Pro Met Leu Trp Ala Leu Ala Phe Leu Phe Thr Val Gly Gly Val Thr
370 375 380

Gly Val Val Ile Ala Gln Gly Ser Leu Asp Arg Val Tyr His Asp Thr
385 390 395 400

Tyr Tyr Ile Val Ala His Phe His Tyr Val Met Ser Leu Gly Ala Leu
405 410 415

Phe Ala Ile Phe Ala Gly Thr Tyr Tyr Ser Ile Gly Lys Met Ser Gly
420 425 430

Arg Gln Tyr Pro Glu Trp Ala Gly Gln Leu His Phe Trp Met Met Phe
435 440 445

Q1

Ile Gly Ser Asn Leu Ile Phe Phe Pro Gln His Phe Leu Gly Arg Gln
450 455 460

Gly Met Pro Arg Arg Tyr Ile Asp Tyr Pro Val Glu Phe Ser Tyr Trp
465 470 475 480

Asn Asn Ile Ser Ser Ile Gly Ala Tyr Ile Ser Phe Ala Ser Phe Leu
485 490 495

Phe Phe Ile Gly Ile Val Phe Tyr Thr Leu Phe Ala Gly Lys Pro Val
500 505 510

Asn Val Pro Asn Tyr Trp Asn Glu His Ala Asp Thr Leu Glu Trp Thr
515 520 525

Leu Pro Ser Pro Pro Pro Glu His Thr Phe Glu Thr Leu Pro Lys Pro
530 535 540

Glu Asp Trp Asp Arg Ala Gln Ala His Arg
545 550

<210> 20

<211> 565
<212> PRT
<213> Rhodobacter sphaeroides

<400> 20

Met Ala Asp Ala Ala Ile His Gly His Glu His Asp Arg Arg Gly Phe
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Phe Thr Arg Trp Phe Met Ser Thr Asn His Lys Asp Ile Gly Val Leu
20 25 30

Tyr Leu Phe Thr Gly Gly Leu Val Gly Leu Ile Ser Val Ala Phe Thr
35 40 45

Val Tyr Met Arg Met Glu Leu Met Ala Pro Gly Val Gln Phe Met Cys
50 55 60

Ala Glu His Leu Glu Ser Gly Leu Val Lys Gly Phe Phe Gln Ser Leu
65 70 75 80

Q1 Trp Pro Ser Ala Val Glu Asn Cys Thr Pro Asn Gly His Leu Trp Asn
85 90 95

Val Met Ile Tyr Gly His Gly Ile Leu Met Met Phe Phe Val Val Ile
100 105 110

Pro Ala Leu Phe Gly Gly Phe Gly Asn Tyr Phe Met Pro Leu His Ile
115 120 125

Gly Ala Pro Asp Met Ala Phe Pro Arg Met Asn Asn Leu Ser Tyr Trp
130 135 140

Leu Tyr Val Ala Gly Thr Ser Leu Ala Val Ala Ser Leu Phe Ala Pro
145 150 155 160

Gly Gly Asn Gly Gln Leu Gly Ser Gly Ile Gly Trp Val Leu Tyr Pro
165 170 175

Pro Leu Ser Thr Ser Glu Ser Gly Tyr Ser Thr Asp Leu Ala Ile Phe
180 185 190

Ala Val His Leu Ser Gly Ala Ser Ser Ile Leu Gly Ala Ile Asn Met
195 200 205

Ile Thr Thr Phe Leu Met Asn Arg Ala Pro Gly Met Thr Met His Lys
210 215 220

Val Pro Leu Phe Ala Trp Ser Ile Phe Val Thr Ala Trp Leu Ile Leu
225 230 235 240

Leu Ala Leu Pro Val Leu Ala Gly Ala Ile Thr Met Leu Leu Thr Asp
245 250 255

Arg Asn Phe Gly Thr Thr Phe Phe Gln Pro Ser Gly Gly Gly Asp Pro
260 265 270

Val Leu Tyr Gln His Ile Leu Trp Phe Phe Gly His Pro Glu Val Tyr
275 280 285

Ile Ile Val Leu Pro Ala Phe Gly Ile Val Ser His Val Ile Ala Thr
290 295 300

Phe Ala Lys Lys Pro Ile Phe Gly Tyr Leu Pro Met Val Tyr Ala Met
305 310 315 320

Val Ala Ile Gly Val Leu Gly Phe Val Val Trp Ala His His Met Tyr
325 330 335

Thr Ala Gly Leu Ser Leu Thr Gln Gln Ser Tyr Phe Met Met Ala Thr
340 345 350

Met Val Ile Ala Val Pro Thr Gly Ile Lys Ile Phe Ser Trp Ile Ala
355 360 365

Thr Met Trp Gly Gly Ser Ile Glu Leu Lys Thr Pro Met Leu Trp Ala
370 375 380

Leu Gly Phe Leu Phe Leu Phe Thr Val Gly Gly Val Thr Gly Ile Val
385 390 395 400

Leu Ser Gln Ala Ser Val Asp Arg Tyr Tyr His Asp Thr Tyr Tyr Val
405 410 415

Val Ala His Phe His Tyr Val Met Ser Leu Gly Ala Val Phe Gly Ile
420 425 430

Phe Ala Gly Ser Thr Ser Gly Ile Gly Lys Met Ser Gly Arg Gln Tyr
435 440 445

Pro Glu Trp Ala Gly Lys Leu His Phe Trp Met Met Phe Val Gly Ala
450 455 460

Asn Leu Thr Phe Phe Pro Gln His Phe Leu Gly Arg Gln Gly Met Pro
465 470 475 480

Arg Arg Tyr Ile Asp Tyr Pro Glu Ala Phe Ala Thr Trp Asn Phe Val
485 490 495

Ser Ser Leu Gly Ala Phe Leu Ser Phe Ala Ser Phe Leu Phe Phe Leu
500 505 510

Gly Val Ile Phe Tyr Ser Leu Ser Gly Ala Arg Val Thr Ala Asn Asn
515 520 525

Q1 Tyr Trp Asn Glu His Ala Asp Thr Leu Glu Trp Thr Leu Thr Ser Pro
530 535 540

Pro Pro Glu His Thr Phe Glu Gln Leu Pro Lys Arg Glu Asp Trp Glu
545 550 555 560

Arg Ala Pro Ala His
565

<210> 21
<211> 514
<212> PRT
<213> Bovine (Mitochondria)

<400> 21

Met Phe Ile Asn Arg Trp Leu Phe Ser Thr Asn His Lys Asp Ile Gly
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Thr Leu Tyr Leu Leu Phe Gly Ala Trp Ala Gly Met Val Gly Thr Ala
20 25 30

Leu Ser Leu Leu Ile Arg Ala Glu Leu Gly Gln Pro Gly Thr Leu Leu
35 40 45

Gly Asp Asp Gln Ile Tyr Asn Val Val Val Thr Ala His Ala Phe Val
50 55 60

Met Ile Phe Phe Met Val Met Pro Ile Met Ile Gly Gly Phe Gly Asn
65 70 75 80

Trp Leu Val Pro Leu Met Ile Gly Ala Pro Asp Met Ala Phe Pro Arg
85 90 95

Met Asn Asn Met Ser Phe Trp Leu Leu Pro Pro Ser Phe Leu Leu Leu
100 105 110

Leu Ala Ser Ser Met Val Glu Ala Gly Ala Gly Thr Gly Trp Thr Val
115 120 125

Tyr Pro Pro Leu Ala Gly Asn Leu Ala His Ala Gly Ala Ser Val Asp
130 135 140

Leu Thr Ile Phe Ser Leu His Leu Ala Gly Val Ser Ser Ile Leu Gly
145 150 155 160

R1

Ala Ile Asn Phe Ile Thr Thr Ile Ile Asn Met Lys Pro Pro Ala Met
165 170 175

Ser Gln Tyr Gln Thr Pro Leu Phe Val Trp Ser Val Met Ile Thr Ala
180 185 190

Val Leu Leu Leu Leu Ser Leu Pro Val Leu Ala Ala Gly Ile Thr Met
195 200 205

Leu Leu Thr Asp Arg Asn Leu Asn Thr Thr Phe Phe Asp Pro Ala Gly
210 215 220

Gly Gly Asp Pro Ile Leu Tyr Gln His Leu Phe Trp Phe Phe Gly His
225 230 235 240

Pro Glu Val Tyr Ile Leu Ile Leu Pro Gly Phe Gly Met Ile Ser His
245 250 255

Ile Val Thr Tyr Tyr Ser Gly Lys Lys Glu Pro Phe Gly Tyr Met Gly
260 265 270

Met Val Trp Ala Met Met Ser Ile Gly Phe Leu Gly Phe Ile Val Trp
275 280 285

Ala His His Met Phe Thr Val Gly Met Asp Val Asp Thr Arg Ala Tyr
290 295 300

Phe Thr Ser Ala Thr Met Ile Ile Ala Ile Pro Thr Gly Val Lys Val
305 310 315 320

Phe Ser Trp Leu Ala Thr Leu His Gly Gly Asn Ile Lys Trp Ser Pro
325 330 335

Ala Met Met Trp Ala Leu Gly Phe Ile Phe Leu Phe Thr Val Gly Gly
340 345 350

Leu Thr Gly Ile Val Leu Ala Asn Ser Ser Leu Asp Ile Val Leu His
355 360 365

Asp Thr Tyr Tyr Val Val Ala His Phe His Tyr Val Leu Ser Met Gly
370 375 380

Q1

Ala Val Phe Ala Ile Met Gly Gly Phe Val His Trp Phe Pro Leu Phe
385 390 395 400

Ser Gly Tyr Thr Leu Asn Asp Thr Trp Ala Lys Ile His Phe Ala Ile
405 410 415

Met Phe Val Gly Val Asn Met Thr Phe Phe Pro Gln His Phe Leu Gly
420 425 430

Leu Ser Gly Met Pro Arg Arg Tyr Ser Asp Tyr Pro Asp Ala Tyr Thr
435 440 445

Met Trp Asn Thr Ile Ser Ser Met Gly Ser Phe Ile Ser Leu Thr Ala
450 455 460

Val Met Leu Met Val Phe Ile Ile Trp Glu Ala Phe Ala Ser Lys Arg
465 470 475 480

Glu Val Leu Thr Val Asp Leu Thr Thr Thr Asn Leu Glu Trp Leu Asn
485 490 495

Gly Cys Pro Pro Pro Tyr His Thr Phe Glu Glu Pro Thr Tyr Val Asn
500 505 510

Leu Lys

<210> 22
<211> 297
<212> PRT
<213> Paracoccus denitrificans

<400> 22

Met Ala Ile Ala Thr Lys Arg Arg Gly Val Ala Ala Val Met Ser Leu
1 5 10 15

Gly Val Ala Thr Met Thr Ala Val Pro Ala Leu Ala Gln Asp Val Leu
20 25 30

Gly Asp Leu Pro Val Ile Gly Lys Pro Val Asn Gly Gly Met Asn Phe
35 40 45

Q1

Gln Pro Ala Ser Ser Pro Leu Ala His Asp Gln Gln Trp Leu Asp His
50 55 60

Phe Val Leu Tyr Ile Ile Thr Ala Val Thr Ile Phe Val Cys Leu Leu
65 70 75 80

Leu Leu Ile Cys Ile Val Arg Phe Asn Arg Arg Ala Asn Pro Val Pro
85 90 95

Ala Arg Phe Thr His Asn Thr Pro Ile Glu Val Ile Trp Thr Leu Val
100 105 110

Pro Val Leu Ile Leu Val Ala Ile Gly Ala Phe Ser Leu Pro Ile Leu
115 120 125

Phe Arg Ser Gln Glu Met Pro Asn Asp Pro Asp Leu Val Ile Lys Ala
130 135 140

Ile Gly His Gln Trp Tyr Trp Ser Tyr Glu Tyr Pro Asn Asp Ala Phe
145 150 155 160

Ala Phe Asp Ala Leu Met Leu Glu Lys Glu Ala Leu Ala Asp Ala Gly
165 170 175

Tyr Ser Glu Asp Glu Tyr Leu Leu Ala Thr Asp Asn Pro Val Val Val
180 185 190

Pro Val Gly Lys Lys Val Leu Val Gln Val Thr Ala Thr Asp Val Ile
195 200 205

His Ala Trp Thr Ile Pro Ala Phe Ala Val Lys Gln Asp Ala Val Pro
210 215 220

Gly Arg Ile Ala Gln Leu Trp Phe Ser Val Asp Gln Glu Gly Val Tyr
225 230 235 240

Phe Gly Gln Cys Ser Glu Leu Cys Gly Ile Asn His Ala Tyr Met Pro
245 250 255

Ile Val Val Lys Ala Val Ser Gln Glu Lys Tyr Glu Ala Trp Leu Ala
260 265 270

Q1 Gly Ala Lys Glu Glu Phe Ala Ala Asp Ala Ser Asp Tyr Leu Pro Ala
275 280 285

Ser Pro Val Lys Leu Ala Ser Ala Glu
290 295

<210> 23
<211> 302
<212> PRT
<213> Rhodobacter sphaeroides

<400> 23

Met Arg His Ser Thr Thr Leu Thr Pro Cys Ala Thr Gly Ala Ala Gly
1 5 10 15

Leu Leu Ala Ala Thr Ala Ala Ala Ala Gln Gln Gln Thr Leu Glu Ile
20 25 30

Ile Gly Arg Pro Gln Pro Gly Gly Thr Gly Phe His Gly Ser Ala Ser
35 40 45

Pro Val Ala Thr Gln Ile His Trp Leu Asp Gly Phe Ile Leu Val Ile
50 55 60

Ile Gly Ala Ile Thr Ile Phe Val Thr Leu Leu Ile Leu Tyr Ala Val
65 70 75 80

Trp Arg Phe His Glu Lys Arg Asn Lys Val Pro Ala Arg Phe Thr His
85 90 95

Asn Ser Pro Leu Glu Ile Ala Trp Thr Ile Val Pro Ile Val Ile Leu
100 105 110

Val Ala Ile Gly Ala Phe Ser Leu Pro Val Leu Phe Asn Gln Gln Glu
115 120 125

Ile Pro Glu Ala Asp Glu Thr Val Lys Val Thr Gly Tyr Gln Trp Tyr
130 135 140

Trp Gly Tyr Glu Tyr Pro Asp Glu Glu Ile Ser Phe Glu Ser Tyr Met
145 150 155 160

Ile Gly Ser Pro Ala Thr Gly Gly Asp Asn Arg Met Ser Pro Glu Val
165 170 175

Glu Gln Gln Leu Ile Glu Ala Gly Tyr Thr Arg Asp Glu Phe Leu Leu
180 185 190

Ala Thr Asp Thr Ala Met Val Val Pro Val Asn Lys Thr Val Val Val
195 200 205

Gln Val Thr Gly Ala Asp Val Ile His Ser Trp Thr Val Pro Phe Gly
210 215 220

Val Arg Gln Asp Ala Val Pro Gly Arg Leu Ala Gln Leu Trp Phe Arg
225 230 235 240

Ala Glu Arg Glu Gly Ile Phe Phe Gly Gln Cys Ser Glu Leu Cys Gly
245 250 255

Ile Ser His Ala Tyr Met Pro Ile Thr Val Lys Val Val Ser Glu Glu
260 265 270

Ala Tyr Ala Ala Trp Leu Glu Gln Ala Arg Gly Gly Thr Tyr Glu Leu
275 280 285

Ser Ser Val Leu Pro Ala Thr Pro Ala Gly Val Ser Val Glu
290 295 300

<210> 24

<211> 227
<212> PRT
<213> Bovine (Mitochondria)

<400> 24

Met Ala Tyr Pro Met Gln Leu Gly Phe Gln Asp Ala Thr Ser Pro Ile
1 5 10 15

Met Glu Glu Leu Leu His Phe His Asp His Thr Leu Met Ile Val Phe
20 25 30

Leu Ile Ser Ser Leu Val Leu Tyr Ile Ile Ser Leu Ile Leu Thr Thr
35 40 45

Lys Leu Thr His Thr Ser Thr Met Asp Pro Gln Glu Val Glu Thr Ile
50 55 60

Q1 Trp Thr Ile Leu Pro Ala Ile Ile Leu Ile Leu Ile Ala Leu Pro Ser
65 70 75 80

Leu Arg Ile Leu Tyr Met Met Asp Glu Ile Asn Asn Pro Ser Leu Thr
85 90 95

Val Lys Thr Met Gly His Gln Trp Tyr Trp Ser Tyr Glu Tyr Thr Asp
100 105 110

Tyr Glu Asp Leu Ser Leu Asp Ser Tyr Met Ile Pro Thr Ser Glu Leu
115 120 125

Lys Pro Gly Glu Leu Arg Leu Leu Glu Val Asp Asn Arg Val Val Leu
130 135 140

Pro Met Glu Met Thr Ile Arg Met Leu Val Ser Ser Gly Asp Val Leu
145 150 155 160

His Ser Trp Ala Val Pro Ser Leu Gly Leu Lys Thr Asp Ala Ile Pro
165 170 175

Gly Arg Leu Asn Gln Thr Thr Leu Met Ser Ser Arg Pro Gly Leu Tyr
180 185 190

Tyr Gly Gln Cys Ser Glu Ile Cys Gly Ser Asn His Ser Phe Met Pro
195 200 205

Ile Val Leu Glu Leu Val Pro Leu Lys Tyr Phe Glu Lys Trp Ser Ala
210 215 220

Ser Met Leu
225

<210> 25
<211> 56
<212> PRT
<213> G. oxydans DSM 4025 PCR product

<400> 25

Gln Phe Thr His Asn Thr Pro Leu Glu Ile Val Trp Thr Ile Val Pro
1 5 10 15

Val Val Ile Leu Val Phe Ile Gly Ala Phe Ser Leu Pro Val Leu Phe
20 25 30

Q1

Lys Gln Gln Glu Phe Pro Glu Gly Asp Ile Val Ile Asn Val Glu Gly
35 40 45

Arg Ser Trp Tyr Trp Gly Tyr Glu
50 55

<210> 26
<211> 274
<212> PRT
<213> Paracoccus denitrificans

<400> 26

Met Ala His Val Lys Asn His Asp Tyr Gln Ile Leu Pro Pro Ser Ile
1 5 10 15

Trp Pro Phe Phe Gly Ala Ile Gly Ala Phe Val Met Leu Thr Gly Ala
20 25 30

Val Ala Trp Met Lys Gly Ile Thr Phe Phe Gly Leu Pro Val Glu Gly
35 40 45

Pro Trp Met Phe Leu Ile Gly Leu Val Gly Val Leu Tyr Val Met Phe
50 55 60

Gly Trp Trp Ala Asp Val Val Asn Glu Gly Glu Thr Gly Glu His Thr
65 70 75 80

Pro Val Val Arg Ile Gly Leu Gln Tyr Gly Phe Ile Leu Phe Ile Met
85 90 95

Ser Glu Val Met Phe Phe Val Ala Trp Phe Trp Ala Phe Ile Lys Asn
100 105 110

Ala Leu Tyr Pro Met Gly Pro Asp Ser Pro Ile Lys Asp Gly Val Met
115 120 125

Pro Pro Glu Gly Ile Val Thr Phe Asp Pro Trp His Leu Pro Leu Ile
130 135 140

Asn Thr Leu Ile Leu Leu Leu Ser Gly Val Ala Val Thr Trp Ala His
145 150 155 160

Q1

His Ala Phe Val Leu Glu Gly Asp Arg Lys Thr Thr Ile Asn Gly Leu
165 170 175

Ile Val Ala Val Ile Leu Gly Val Cys Phe Thr Gly Leu Gln Ala Tyr
180 185 190

Glu Tyr Ser His Ala Ala Phe Gly Leu Ala Asp Thr Val Tyr Ala Gly
195 200 205

Ala Phe Tyr Met Ala Thr Gly Phe His Gly Ala His Val Ile Ile Gly
210 215 220

Thr Ile Phe Leu Phe Val Cys Leu Ile Arg Leu Leu Lys Gly Ala Met
225 230 235 240

Thr Gln Lys Gln His Val Gly Phe Glu Ala Ala Ala Trp Tyr Trp His
245 250 255

Phe Val Asp Val Val Trp Leu Phe Leu Phe Val Val Ile Tyr Ile Trp
260 265 270

Gly Arg

<210> 27
<211> 266
<212> PRT

<213> Rhodobacter sphaeroides

<400> 27

Met Ala His Ala Lys Asn His Asp Tyr His Ile Leu Pro Pro Ser Ile
1 5 10 15

Trp Pro Phe Met Ala Ser Val Gly Ala Phe Val Met Leu Asn Gly Ala
20 25 30

Val Leu Trp Met His Gly Ser Gly Pro Trp Met Gly Leu Ile Gly Leu
35 40 45

Val Val Val Leu Tyr Thr Met Phe Gly Trp Trp Ser Asp Val Val Thr
50 55 60

Glu Ser Leu Glu Gly Asp His Thr Pro Val Val Arg Leu Gly Leu Arg
65 70 75 80

Q1

Trp Gly Phe Ile Leu Phe Ile Met Ser Glu Val Ile Phe Phe Ser Ala
85 90 95

Trp Phe Trp Ser Phe Phe Lys His Ala Leu Tyr Pro Met Gly Pro Glu
100 105 110

Ser Pro Ile Ile Asp Gly Ile Phe Pro Pro Glu Gly Ile Ile Thr Phe
115 120 125

Asp Pro Trp His Leu Pro Leu Ile Asn Thr Leu Ile Leu Leu Cys Ser
130 135 140

Gly Cys Ala Ala Thr Trp Ala His His Ala Leu Val His Glu Asn Asn
145 150 155 160

Arg Arg Asp Val Ala Trp Gly Leu Ala Leu Ala Ile Ala Leu Gly Ala
165 170 175

Leu Phe Thr Val Phe Gln Ala Tyr Glu Tyr Ser His Ala Ala Phe Gly
180 185 190

Phe Ala Gly Thr Ile Tyr Gly Ala Asn Phe Phe Met Ala Thr Gly Phe
195 200 205

His Gly Phe His Val Ile Val Gly Thr Ile Phe Leu Leu Val Cys Leu

210 215 220

Ile Arg Val Gln Arg Gly His Phe Thr Pro Glu Lys His Val Gly Phe
225 230 235 240

Glu Ala Ala Met Trp Tyr Trp His Phe Val Asp Val Val Trp Leu Phe
245 250 255

Leu Phe Ala Ser Ile Tyr Ile Trp Gly Gln
260 265

<210> 28
<211> 261
<212> PRT
<213> Bovine (Mitochondria)

<400> 28

Q1

Met Thr His Gln Thr His Ala Tyr His Met Val Asn Pro Ser Pro Trp
1 5 10 15

Pro Leu Thr Gly Ala Leu Ser Ala Leu Leu Met Thr Ser Gly Leu Thr
20 25 30

Met Trp Phe His Phe Asn Ser Met Thr Leu Leu Met Ile Gly Leu Thr
35 40 45

Thr Asn Met Leu Thr Met Tyr Gln Trp Trp Arg Asp Val Ile Arg Glu
50 55 60

Ser Thr Phe Gln Gly His His Thr Pro Ala Val Gln Lys Gly Leu Arg
65 70 75 80

Tyr Gly Met Ile Leu Phe Ile Ile Ser Glu Val Leu Phe Phe Thr Gly
85 90 95

Phe Phe Trp Ala Phe Tyr His Ser Ser Leu Ala Pro Thr Pro Glu Leu
100 105 110

Gly Gly Cys Trp Pro Pro Thr Gly Ile His Pro Leu Asn Pro Leu Glu
115 120 125

Val Pro Leu Leu Asn Thr Ser Val Leu Leu Ala Ser Gly Val Ser Ile
130 135 140

Thr Trp Ala His His Ser Leu Met Glu Gly Asp Arg Lys His Met Leu
145 150 155 160

Gln Ala Leu Phe Ile Thr Ile Thr Leu Gly Val Tyr Phe Thr Leu Leu
165 170 175

Gln Ala Ser Glu Tyr Tyr Glu Ala Pro Phe Thr Ile Ser Asp Gly Val
180 185 190

Tyr Gly Ser Thr Phe Phe Val Ala Thr Gly Phe His Gly Leu His Val
195 200 205

Ile Ile Gly Ser Thr Phe Leu Ile Val Cys Phe Phe Arg Gln Leu Lys
210 215 220

Phe His Phe Thr Ser Asn His His Phe Gly Phe Glu Ala Gly Ala Trp
225 230 235 240

Tyr Trp His Phe Val Asp Val Val Trp Leu Phe Leu Tyr Val Ser Ile
245 250 255

Tyr Trp Trp Gly Ser
260

<210> 29
<211> 44
<212> PRT
<213> G. oxydans DSM 4025 PCR product

<400> 29

Thr Trp Ala His His Ala Ile Val His Gly Asp Arg Lys Lys Thr Ala
1 5 10 15

Ile Gly Leu Ala Ile Ala Ile Gly Leu Gly Trp Ile Phe Thr Leu Cys
20 25 30

Gln Ala Tyr Glu Tyr Tyr Glu Ile Val His Thr Glu
35 40

<210> 30
<211> 35
<212> PRT
<213> G. oxydans DSM 4025 PCR product

<400> 30

Asp Ser Ile Phe Leu Leu Val Cys Leu Ile Arg Ile Leu Arg Gly Ala
1 5 10 15

Met Ser Ala Lys Gln His Val Gly Phe Glu Met Ala Ala Trp Tyr Trp
20 25 30

His Phe Val
35

<210> 31
<211> 17
<212> DNA
<213> PCR Primer

<220>
<221> misc_feature
<222> (1)..(17)
<223> n can be either a, t, g, or c.

Q1

<400> 31
tggttcttcg gncaccc 17

<210> 32
<211> 18
<212> DNA
<213> PCR Primer

<220>
<221> misc_feature
<222> (1)..(18)
<223> n can be a, t, g or c.

<400> 32
canacccgng tagtatac 18

<210> 33
<211> 17
<212> DNA
<213> PCR Primer

<220>
<221> misc_feature
<222> (1)..(17)
<223> n can be a, t, g or c.

<400> 33
caatttacnc ataatac 17

<210> 34
<211> 20
<212> DNA
<213> PCR Primer

<220>
<221> misc_feature
<222> (1)..(20)
<223> n can be a, t, g or c.

<400> 34
accataaccc cnatacttat 20

<210> 35
<211> 17
<212> DNA
<213> PCR Primer

<220>
<221> misc_feature
<222> (1)..(17)
<223> n can be a, t, g or c.

<400> 35
cantgggcnc atcatgc 17

<210> 36
<211> 20
<212> DNA
<213> PCR Primer

<220>
<221> misc_feature
<222> (1)..(20)
<223> n can be a, t, g or c.

<400> 36
accataaccg taaaacanct 20